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(71) Applicant: Nippon Telegram & Telephone Corporation

(72) Inventor: TSUYUSAKI et al.

(74) Agent: Patent Attorney, Masaki YAMAKAWA

(54) [Title of the Invention] VACUUM SUCTION DEVICE

(57) [Abstract]

[Object] A sample is corrected to have a satisfactory flat surface.

[Solving Means] The upper surfaces of projections 2, 11, 12 form the same plane, and support a sample 6. The height of the upper surfaces of first and second static-pressure portions 13 and 14 is slightly lowered than the height of the upper surface of the projections 2 to form fine gaps 23 and 24 between the seal portions and the sample 6. The fine gaps 23 and 24 exhibit a large resistance to reduce the amount of air flowing into a vacuum suction sticking portion 3 at the time of vacuum suction. Positive pressure air puts an annular groove 15 into the positive pressure state to prevent external air from flowing the fine gap 24. The fine

gap 23 exhibits a large resistance to the positive pressure air to reduce the positive pressure air flowing into the vacuum suction sticking portion 3.

[Claims]

[Claim 1] A vacuum suction device in which a sample is supported only by lots of projections having the upper surfaces positioned in the same plane, and which is provided with a vacuum suction sticking unit having an evacuating hole disposed therein in connection to a vacuum pump, characterized in that a vacuum suction sticking portion communicatively connected to the evacuating hole is formed in the central portion on the upper surface of the vacuum-suction sticking unit, and an annular positive pressure portion is formed so as to surround the vacuum suction sticking portion and is communicatively connected to a positive pressure supplying hole.

[Claim 2] A vacuum suction device in which a sample is supported only by lots of projections having the upper surfaces positioned in the same plane, and which is provided with a vacuum suction sticking unit having an evacuating hole disposed therein in connection to a vacuum pump, characterized in that the device is provided with: a vacuum suction sticking portion communicatively connected to the evacuating hole formed in the central portion on the upper surface of the vacuum-suction sticking unit; a first static-pressure sealing portion formed of an annular protuberant portion surrounding the vacuum-suction sticking portion; a annular groove surrounding the first static sealing portion;

and a second static pressure sealing portion formed of an annular protuberant portion surrounding the annular groove, a positive pressure supplying hole communicatively connected to the annular groove is disposed inside the vacuum-suction sticking unit, and projections in the first and second static pressure sealing portions are set to be slightly shorter than the projections in the vacuum-suction sticking portion to form a fine gap between the upper surfaces of the first and second static pressure sealing portions and the sample.

[Claim 3] A vacuum suction device in which a sample is supported only by lots of projections having the upper surfaces positioned in the same plane, and which is provided with a vacuum suction sticking unit having an evacuating hole disposed therein in connection to a vacuum pump, characterized in that the device is provided with: a vacuum suction sticking portion formed on the upper surface of the vacuum suction sticking unit; an evacuating groove formed so as to surround the vacuum suction sticking portion and in such a manner that the evacuating hole is communicatively connected to the vacuum suction sticking portion; a first static-pressure sealing portion which forms the same plane as the vacuum suction sticking portion and surrounds the first static-pressure sealing portion; an annular groove surrounding the first static-pressure sealing portion; and a

second annular static-pressure sealing portion which forms the same plane as the vacuum suction sticking portion and the first static-pressure sealing portion, and a positive pressure supplying hole communicatively connected to the annular groove is formed inside the vacuum suction sticking unit.

[Claim 4] The vacuum suction device according to Claim 1, 2, or 3, characterized in that the projections are formed in a pin-like shape.

[Claim 5] The vacuum suction device according to Claim 2, characterized in that the second static-pressure sealing portion is lower than the first static-pressure sealing portion.

[Claim 6] The vacuum suction device according to Claim 2, characterized in that a ring is detachably disposed in the annular groove, and an annular sealing member is fastened at least to the upper surface of the ring and is adapted to comes into close contact with the back surface of the sample at the time of vacuum- sucking and supplying positive-pressure air.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention] The present invention relates to a vacuum suction device for use in pattern transfer devices and drawing devices provided in LSI

manufacturing apparatuses, different types of process manufacturing apparatuses, inspection length-measuring devices, or working apparatuses for grinding, polishing, cutting, and so forth, and in particular to a vacuum suction unit of the vacuum suction device.

[0002]

[Related Art of the Invention] A conventional vacuum suction device of the above-described type for use in the production of LSI is provided with a vacuum suction unit, as shown in Fig. 5(a) and (b). Hereinafter, the vacuum suction unit will be briefly explained. Reference numeral 1 designates a vacuum suction unit. The vacuum suction unit is provided with a vacuum suction portion 3 having lots of fine projections 2 for the vacuum-suction fixing a sample 6 such as a wafer or the like. The vacuum suction portion 3 is formed in the central portion on the upper side of the unit. Moreover, a land 4, which is an annular protuberant portion, is formed on the outside of the vacuum suction portion 3. The land 4 has the same height as the projections 2, and the upper surface is finish-machined to form the high precision upper surface. Similarly, the upper surfaces of the projections 2 are finish-machined to form high precision flat surfaces. Moreover, four evacuating holes 5 are formed inside the vacuum suction unit 1. One end of each evacuating hole 5 is opened in the bottom 3a of

the vacuum suction portion 3, and the other end thereof is opened in the lower surface 1a of the vacuum suction unit 1. The opening in the other end is connected to a vacuum pump (not shown).

[0003] In the above-described structure, a sample 6 is placed on the upper surface of the vacuum suction unit 1, and thereafter, the vacuum pump is actuated, so that the air below the sample 6 is exhausted through the evacuating holes 5. The pressure of the vacuum suction portion 3 becomes negative, so that the sample 6 is suction-stuck to the projections 2 and the land 4. The upper surface of the land 4 and the upper surfaces of the projections 2 form the same plane. Thus, the outer peripheral portion of the back surface of the sample 6 is brought into close contact with the upper surface of the land 4. Thus, the vacuum suction portion 3, which exists on the inner side of the land 4, is vacuum-sealed. The sample 6 follows the upper surfaces which are finish-machined at high precision of the projections 2 and the land 4, so that the distortions and bends of the sample 6 can be corrected.

[0004]

[Problems to be Solved by the Invention] Referring to the vacuum suction unit of the above-described conventional vacuum suction device, the sample 6 is suction-stuck to the upper surfaces of the projections 2 of the vacuum suction

portion 3 and the land 4, due to the evacuation. Thereby, the distortion and deformation of the sample 6 can be corrected, so that the surface can be made flat. Moreover, the projections 2 are effective in considerably reducing the contact area between the vacuum suction unit 1 and the sample 6. Accordingly, the deterioration of the flatness, which will occur due to dusts or the like, can be suppressed. In this case, since the sample 6 is supported by the projections 2 only, the vacuum suction portion 3 is communicatively connected to the outside, so that a vacuum degree sufficient for the suction-sticking of the sample 6 can not be attained. Moreover, external air or a working liquid is sucked into the vacuum suction portion to contaminate the sample 6 and the vacuum suction portion. Thus, conventionally, the land 4 is provided to vacuum-seal the vacuum suction portion 3. For sufficient vacuum-sealing, it is required to increase the width of the land 4. With increasing of the width of the land 4, dusts or the like will adhere to the land 4 with more probability. Thus, problematically, it is impossible to correct the peripheral portion of the sample to a high precision flat surface.

[0005] In view of the above-described problems, the present invention has been devised. It is an object of the present invention to provide a vacuum suction device in which a sample can be assuredly suction-stuck, although the sample

is supported by projections only, the outer peripheral portion of the sample is not affected by dusts or the like, and the sample can be corrected to a high precision surface.

[0006]

[Means for Solving the Problems] According to the present invention, the vacuum suction device in which a sample is supported only by lots of projections having the upper surfaces positioned in the same plane, and which is provided with a vacuum suction sticking unit having an evacuating hole disposed therein in connection to a vacuum pump is characterized in that a vacuum suction sticking portion communicatively connected to the evacuating hole is formed in the central portion on the upper surface of the vacuum-suction sticking unit, and an annular positive pressure portion is formed so as to surround the vacuum suction sticking portion and is communicatively connected to a positive pressure supplying hole. According to the present invention, the vacuum suction device in which a sample is supported only by lots of projections having the upper surfaces positioned in the same plane, and which is provided with a vacuum suction sticking unit having an evacuating hole disposed therein in connection to a vacuum pump is characterized in that the device is provided with a vacuum suction sticking portion communicatively connected to the evacuating hole formed in the central portion on the upper

surface of the vacuum-suction sticking unit, a first static-pressure sealing portion formed of an annular protuberant portion surrounding the vacuum-suction sticking portion, a annular groove surrounding the first static sealing portion, and a second static pressure sealing portion formed of an annular protuberant portion surrounding the annular groove, a positive pressure supplying hole communicatively connected to the annular groove is disposed inside the vacuum-suction sticking unit, and projections in the first and second static pressure sealing portions are set to be slightly shorter than the projections in the vacuum-suction sticking portion to form a fine gap between the upper surfaces of the first and second static pressure sealing portions and the sample. Moreover, according to the present invention, the vacuum suction device in which a sample is supported only by lots of projections having the upper surfaces positioned in the same plane, and which is provided with a vacuum suction sticking unit having an evacuating hole disposed therein in connection to a vacuum pump is characterized in that the device is provided with a vacuum suction sticking portion formed on the upper surface of the vacuum suction sticking unit, an evacuating groove formed so as to surround the vacuum suction sticking portion and in such a manner that the evacuating hole is communicatively connected to the vacuum suction sticking portion, a first static-pressure

sealing portion which forms the same plane as the vacuum suction sticking portion and surrounds the first static-pressure sealing portion, an annular groove surrounding the first static-pressure sealing portion, a second annular static-pressure sealing portion which forms the same plane as the vacuum suction sticking portion and the first static-pressure sealing portion, and a positive pressure supplying hole communicatively connected to the annular groove is formed inside the vacuum suction sticking unit. Also, according to the present invention, characteristically, the projections are formed in a pin-like shape. Moreover, according to the second static-pressure sealing portion is lower than the first static-pressure sealing portion. Furthermore, according to the present invention, a ring is detachably disposed in the annular groove, and an annular sealing member is fastened at least to the upper surface of the ring and is adapted to comes into close contact with the back surface of the sample at the time of vacuum- sucking and supplying positive-pressure air.

[0007]

[Operation] According to the present invention, a sample is supported by the projections only having a very small contact-area for the sample. Thus, dusts and so forth scarcely affect the flatness of the sample. The annular positive-pressure portion surrounding the vacuum-suction

sticking portion is put into the positive-pressure state by the supply of positive-pressure air. This prevents the external invasion of dusts, a working liquid, and so forth. According to the present invention, the two static-pressure sealing portions are formed on the outer side of the vacuum suction sticking portion. A fine gap is formed between the sealing portions and the sample, and positive-pressure air is supplied into the annular groove. Accordingly, the fine gap between the static-pressure sealing portions and the sample exhibits a large resistance at the time of evacuating. Thus, the amount of air sucked into the vacuum suction sticking portion is very slight, so that the vacuum suction sealing portion can be evacuated, i.e., the sample is suction-stuck. On the other hand, the static-pressure sealing portions are put into the positive-pressure state by the supply of the positive-pressure air. Therefore, the external invasion of dusts and a working liquid is prevented. A part of the positive-pressure air flows into the vacuum suction sticking portion. However, the fine gap between the static-pressure sealing portion and the sample exhibits a large resistance. Thus, the amount of the positive-pressure air flowing into the vacuum suction sticking portion is slight, and scarcely affects the vacuum suction sticking of the sample. Moreover, the sealing member is provided in the annular groove, and comes into close contact with the sample

at the time of vacuum-suction sticking and supplying the positive-pressure air. Thereby, the vacuum suction sticking portion is vacuum-sealed, so that no external air and a working liquid invade the vacuum suction sticking portion.

[0008]

[Embodiments] Hereinafter, the present invention will be described in details with reference to the embodiments shown in the drawings. Fig. 1(a) and (b) is a top view of a vacuum suction unit which constitutes the vacuum suction device according to a first embodiment of the present invention, and an expanded cross-sectional view of an essential part of the device. It is to be noted that the same components as described in Prior Art of the Invention are designated by the same reference numerals, and the detailed description is not repeated. In the drawing, a vacuum suction fixing unit 1 of this example having a thick disk shape is provided with a vacuum suction fixing portion 3. The vacuum suction fixing portion 3 is a circular concave portion formed in the central part of the upper surface of the vacuum suction unit 3, and has lots of fine projections 2 in the central part, which are shown by small rectangles in the drawing. Moreover, first and second static pressure sealing portions 13 and 14 are formed in a concentric pattern on the outer side of the vacuum suction portion 3. The sealing portions 13 and 14 are annular

protuberant portions provided with lots of fine projections 11 and 12, respectively, similarly to the vacuum suction portion 3. In this example, an annular groove 15 forming a positive pressure portion is provided between both of the static pressure sealing portions 13 and 14. Evacuating holes 5 and a positive pressure supplying hole 17 are formed in the vacuum suction unit 1. The depth D of the vacuum suction fixing portion 3, i.e., the height of the projections 2 is in the range of about 100 μm to 1 mm. The heights of the static pressure sealing portions 13 and 14 (the height from the bottom 3a of the vacuum suction fixing portion 3) are equal to each other. The height is slightly smaller than the depth D of the vacuum suction portion 3 (by about one-hundredth to one-tenth). The projections of the vacuum suction fixing portion 3, and the static pressure sealing portions 13 and 14 are formed in pin shapes with the same thicknesses. The upper surfaces thereof are finish-machined to be high precision surfaces, which form the same plane. The height d of the projections 2 in the static pressure sealing portions 13 and 14 is in the range of several μm to 50 μm, and thus, is significantly smaller than the height D of the projections 2 in the vacuum suction fixing portion 3. Therefore, fine gaps 23 and 24 are formed between the static pressure sealing portions 13 and 14 and the sample 6. These projections 2, 11, and 12 have

appropriate cross-sections which may be circular, square, and the like, and are formed to be as thin as possible, so that the contact area of the projections for the sample 6 is reduced. In addition, the projections are formed at such intervals, depending on the thickness of the sample 6, that the sample 6 can be prevented from deflecting at the time of vacuum-suction fixing. As material for the projections 2, 11, and 12, ceramics, iron, titanium, and so forth are used. As material for the vacuum suction unit 1, ceramics, hardened metals, and so forth are used.

[0009] One end of each evacuating hole 5 opens in the bottom 3a of the vacuum suction fixing portion 3. The other end opens in the side face of the vacuum suction unit 1, and is connected to a vacuum pump (not shown). One end of the positive pressure supplying hole 17 opens in the peripheral wall of the annular groove 15, and the other end opens in the side face of the vacuum suction unit 1. The opening is connected to a positive-pressure supplying means such as a compressor or the like.

[0010] In the above-described structure, the air in the evacuating holes 5 is exhausted by means of a vacuum pump (not shown), so that the air flows in the direction represented by arrow 21, and the pressure in the vacuum suction fixing portion 3 becomes negative. Accordingly, the sample 6 is pushed against the upper surfaces of the

projections 2, 11, and 12, due to the atmospheric pressure. Thus, distortions and bends are corrected. At this time, the fine gap 23 is formed between the first static pressure sealing portion 13 and the back surface of the sample 6, since the upper surface of the first static pressure sealing portion 13 is set to be slightly lower than the upper surfaces of the projections 11. Thus, the amount of the air flowing into the vacuum suction fixing portion 3 is very small. Therefore, the vacuum suction portion 3 can be evacuated, that is, the sample 6 is suction-stuck. Subsequently, the positive pressure supplying means such as a compressor or the like is actuated, so that the positive pressure air 22 is supplied to the annular groove 15 via the positive pressure supplying hole 17. Thus, the annular groove 15 and the first and second static pressure sealing portions 13 and 14 are put into the positive pressure state. Then, the positive pressure air 22 passes through the fine gap between the sample 6 and the first and second static pressure sealing portions 13 and 14 to be exhausted into the vacuum suction fixing portion 3 and to the outside of the vacuum suction unit 1. At this time, the amount of the positive pressure air 22 flowing into the vacuum suction fixing portion 3 is very small, since the first static pressure sealing portion 13 acts as a large resistance to the positive pressure air. Thus, the positive pressure air

does not affect the vacuum-suction sticking of the sample 6. As for the positive pressure air exhausted through the second static pressure sealing portion 14 to the outside, dusts adhering to the outer peripheral portion on the back side of the sample 6 are removed with the air, and moreover, the air prevents a working liquid or dusts from invading the vacuum suction fixing unit 1 during the processing. Accordingly, the back surface of the sample 6, and the vacuum-suction sticking surfaces of the vacuum suction unit 1, i.e., the upper surfaces of the projections 2, 11, and 12 can be prevented from being contaminated.

[0011] For example, in the case where a sample 6 having a thickness of more than 500 μm is used to be suction-stuck, the intervals between the projections 2, 11, and 12 are set at 1 mm, the projections 2, 11, and 12 have an angular shape with a one-side length of 0.2 mm, substantially no deflection is observed in the sample 6. The contact ratio of the back surface of the sample 6 contacting the upper surfaces of the projections 2, 11, and 13 is very small, i.e., 4%. Accordingly, the influence of dusts exerting over the entire suction-sticking surface of the sample 6 is very low. A high flatness can be achieved. The projections 2, 11, and 12 are formed into a pin-like shape. Dusts or the like less stick to them.

[0012] Fig. 2(a) and (b) are a top view of a vacuum suction

unit according to a second embodiment of the present invention, and an expanded cross-sectional view of an essential part of the unit. A vacuum suction unit 1 of this example is provided with a vacuum suction fixing portion 3, which is a circular concave portion formed in the central part of the upper surface of the vacuum suction unit 1. An annular evacuating groove 30, a first annular static pressure sealing portion 13, an annular groove 15, and a second static pressure sealing portion 14 are formed on the outer side of the vacuum suction fixing portion 3 in a concentric pattern. Lots of fine projections 2, 11, and 12 having circular cross-sections are formed so as to be protuberant in the vacuum suction fixing portion 3, and the first and second static pressure sealing portions 13 and 14. An evacuating hole 5 and a positive pressure supplying hole 17 are formed in the vacuum suction unit 1. The surfaces of the vacuum suction fixing portion 3 and the static pressure sealing portions 13 and 14 from which the projections are projected form the same plane. The projections 2, 11, and 12 have the same height d, e.g., in the range of several μm to 50 μm, and thus, the upper surfaces thereof form the same plane. Accordingly, each fine gap is formed between the sample 6 and each of the vacuum suction portion 3 and the first and second static pressure sealing portions 13 and 14. One end of the evacuating hole 5 is connected to the

evacuating groove 30, and the other end thereof opens in the side face of the vacuum suction unit 1, and is connected to a vacuum pump (not shown). The evacuating groove 30 is provided instead of the formation of plural evacuating holes 5, in order to improve the starting-up of the evacuation.

[0013] In the above-described structure, the contact ratio of the back surface of the sample 6 contacting the upper surfaces of the projections 2, 11, and 13 is very small. Accordingly, the influence of dusts exerting over the entire suction-sticking surface of the sample 6 is very low. A high flatness can be achieved. The first static pressure sealing portions 13 is formed on the outer side of the vacuum suction fixing portion 3, and forms a fine gap with the sample 6. Thus, dusts are prevented from flowing into the vacuum suction fixing portion 3 at the time of vacuum-suction sticking. In addition, when positive pressure air is supplied, the amount of positive pressure air 22 flowing into the vacuum suction fixing portion 3 can be reduced. Accordingly, the sample 6 can be assuredly vacuum-suction stuck. The second static pressure sealing portions 14 is provided on the outer side of the annular groove 15, and form a fine gap with the sample 6. Therefore, the second static pressure sealing portion 14 can be put into the positive pressure state. Thus, the invasion of a working liquid and dusts can be assuredly prevented.

[0014] Fig. 3 is an expanded cross-sectional view of an essential part of a vacuum-suction unit according to a third embodiment of the present invention. The vacuum suction unit 1 of this embodiment is the same as the first example shown in Fig. 1 excepting that the height of the second static pressure sealing portion 14 in the first example shown in Fig. 1 is set to be slightly lower than that of the first static pressure sealing portion 13, and thus, the fine gap 24 between the sample 6 and the second static pressure sealing portion 14 is set to be larger than the fine gap 23 between the sample 6 and the first static pressure sealing portion 13.

[0015] In the above-described structure, the air in the evacuating hole 5 is exhausted, so that the sample 6 is vacuum-sucked, and thereafter, positive pressure air 22 is supplied to the annular groove 15. At this time, the differential pressure between the vacuum suction fixing portion 3 and the annular groove 15 is larger than that between the atmospheric pressure on the outer side of the second static pressure sealing portion 14 through which the positive pressure air 22 is blown toward the outside and the annular groove 15, a larger amount of the positive pressure air 22 tends to flow into the vacuum suction portion 3. However, the fine gap 24 between the second static pressure sealing portion 14 and the sample 6 is set to be larger than

the fine gap 23 between the sample 6 and the first static pressure sealing portion 13. Therefore, the resistance of the second static pressure sealing portion 14 is relatively small, so that a large part of the positive pressure air 22 passes through the fine gap 24 to be discharged to the outside of the vacuum suction unit 1. Thus, according to the above-described structure, the vacuum suction portion 3 can be assuredly vacuum-sealed. Thus, a working liquid can be prevented from invading the fine gap 24 from the outside.

[0016] Fig. 4 is an expanded cross-sectional view of the essential part of a vacuum suction unit according to a fourth embodiment of the present invention. In the vacuum suction unit 1 of this embodiment, a ring 32 having two sealing members 33 is inserted into the annular groove 15 in the first embodiment of Fig. 1. These sealing members 33 are adapted to vacuum-seal the vacuum suction fixing portion 3.

[0017] The ring 32 is detachably inserted along the inner peripheral wall of the annular groove 15. As for the upper and lower surfaces of the ring 32, the half on the outside in the radial direction of each of the upper and lower surfaces is depressed in the entire periphery of the ring 32, as compared with the half on the inside in the radial direction of each of the upper and lower surfaces. Thus, annular step portions 37 and 38 are formed, respectively.

Each sealing member 33 is formed of a very thin ring-shaped sheet (about 10 μm to 30 μm) which is made of a high polymer film such as a polyimide film or the like. The half on the inside in the radial direction of the sheet is fastened to each of the upper and lower surfaces of the ring 32. The halves on the outside in the radial direction of the sealing members 33 are not fastened and extend above and below the step portions 37 and 38, respectively. The upper sealing member 33 is firmly stuck to the back surface of the sample 6 at the time of evacuation or supplying the positive pressure air 22. As a result, the vacuum suction fixing portion 3 is vacuum-sealed. The lower sealing member 33 is pushed against the inner bottom of the annular groove 15 at the time of supplying the positive pressure air to seal the gap between the inner peripheral wall of the annular groove 15 and the ring 32. The step portions 37 and 38 and the sealing members 33 form gaps between them, and make it easy to apply the positive pressure air 22 to the sealing members. With the upper step portion 37, the upper sheet member 33 is prevented from pending to contact the upper surface of the ring, when the upper sheet member is not used. The lower step portion 38 is effective in reducing the upward deformation of the lower sheet member 33.

[0018] According to the above-described structure, a sample 6 such as a wafer or the like is placed on the vacuum

suction unit 1, and the evacuating hole 5 is evacuated by means of a vacuum pump. Thereby, the sample 6 is suction-stuck onto the projections 2, 11, and 12. Accordingly, the sample 6 follows the upper surfaces of the projections 2, 11, and 12, so that the warps and bends of the sample 6 can be corrected. At this time, the upper sealing member 33 is sucked upwardly as shown in the drawing to be closely stuck to the back surface of the sample 6, so as to vacuum-seal the vacuum suction fixing portion 3.

[0019] Thereafter, the positive-pressure air 22 is supplied through the positive pressure supplying hole 17 to the annular groove 15. Since the first and second static pressure sealing portions 13 and 14 exhibit a large resistance to the positive-pressure air 22. Thus, the upper sealing member 33 is pushed against the back surface of the sample 6, and the lower sealing member 33 is pushed against the inner bottom of the annular groove 15. Accordingly, the vacuum suction portion 3 is completely vacuum-sealed. In this state, the sample 6 is worked with flowing of a working liquid. In this case, the working liquid can be prevented from invading the second static pressure sealing portion 14, the annular groove 15, the first static pressure sealing portion 13, and the vacuum-suction sticking portion 3. Accordingly, the contamination of the back surface of the sample 6 and the vacuum-suction sticking portion of the

vacuum suction unit 1 can be prevented, as in the first and second embodiments.

[0020] Moreover, according to the above-described structure, especially, a sample 6 considerably warped upwardly can be effectively suction-stuck. In particular, for the sample 6 considerably warped upwardly, the outer peripheral portion on the back side thereof is out of contact with the projections 12, and a large gap is formed between the outer peripheral portion and the second sealing portion 14. Accordingly, when the air in the evacuating hole 5 is exhausted therefrom, the vacuum degree of the vacuum suction fixing portion 3 can not be increased. However, since the ring 32 and the sealing member 33 are disposed in the annular groove 15, the end portion on the outer peripheral side of the upper sealing member 33 is raised upwardly to come into close contact with the back surface of the sample 6. Thus, the vacuum suction fixing portion 3 is sealed. The vacuum degree of the vacuum suction fixing portion 3 is enhanced, so that the sample 6 is suction-stuck. Moreover, the positive-pressure air 22 is supplied into the annular groove 15, and thus, the upper sealing member 33 is pushed against the back surface of the sample 6. Accordingly, the vacuum suction fixing portion 3 is properly sealed. On the other hand, when the positive pressure air 22 is supplied into the annular groove 15, the lower sealing member 33 is

pushed against the inner bottom of the annular groove 15. Thus, the gap between the inner peripheral wall of the annular groove 15 and the ring 32 is sealed.

[0021] According to this embodiment, the ring 32 is detachably disposed in the annular groove 15 along the inner peripheral wall thereof. Accordingly, the ring 32 may be applied only when a sample 6 warped considerably is vacuum-suction stuck, and is removed in other cases. Accordingly, the degradation of the sealing members 33 can be prevented, and these members can be used for a long time.

[0022] In the above-described first to fourth embodiments, the projections 2, 11, and 12 having a fine pin-like shape are described by way of an example. The projections are not restricted to the pin-like shape, and may be elongated projections having an annular shape, a spiral shape, or the like. In the above-described first to fourth embodiments, the vacuum suction portion 3 is formed in a circular shape. The portion 3 may be formed in a rectangular shape or an ellipsoidal shape. In the fourth embodiment of Fig. 4, the sealing members 33 fastened to the upper and lower surfaces of the ring 32 is described by way of an example. The fine gap 23 can be also vacuum-sealed by the sealing member which is fastened only to the upper surface of the ring 32.

[0023]

[Advantages] As described above, in the vacuum suction

device of the present invention in which a sample is supported by lots of projections only having the upper surfaces positioned in the same plane, and which is provided with a vacuum suction sticking unit having an evacuating hole disposed therein in connection to a vacuum pump, a vacuum suction sticking portion communicatively connected to the evacuating hole is formed in the central portion on the upper surface of the vacuum-suction sticking unit, and an annular positive pressure portion is formed so as to surround the vacuum suction sticking portion and is communicatively connected to a positive pressure supplying hole. In contrast to a conventional device, it is not necessary to provide a land for supporting the outer peripheral portion on the back side of a sample. The sample is supported only by the projections. The contact area between the sample and the vacuum suction sticking unit can be reduced. Accordingly, the affect by dusts can be reduced. Warps and bends in the sample can be corrected to obtain a highly flat surface. The positive-pressure portions are put into the positive-pressure state at the time of working, so that external dusts and working liquid can be prevented from invading.

[0024] According to the present invention, the vacuum suction sticking portion is formed as a depressed portion. The vacuum pressure distribution in the evacuating portion

is uniform. The sample can be sufficiently suction-stuck.

[0025] According to the present invention, the vacuum suction sticking portion and the first and second static-pressure sealing portions form the same plane. Thus, the vacuum suction sticking unit can be easily formed by working.

[0026] Moreover, according to the present invention, the annular evacuating groove is formed between the vacuum suction sticking portion and the first static-pressure sealing portion in the vacuum-suction unit. The evacuating hole is connected to the evacuating groove. Therefore, the vacuuming can be efficiently started at the time of evacuation. The sample can be vacuum-suction stuck in a short time.

[0027] According to the present invention, the annular groove is formed between the first and second static-pressure sealing portions. The ring having the annular sealing member is disposed in the annular groove. The sealing member is caused to come into close contact with the back surface of the sample at the time of vacuum-sucking and supplying the positive-pressure air. Thus, the vacuum suction sticking portion can be assuredly vacuum-sealed at the time of vacuum-sucking and supplying the positive-pressure air. By using the sealing member, the vacuum degree in the vacuum suction sticking portion can be enhanced, especially when a sample considerably warped

upwardly is suction-stuck. Thus, the sample can be assuredly vacuum-suction stuck.

[0028] Moreover, according to the present invention, the second static-pressure sealing portion is set to be lower than the first static-pressure sealing portion, and thus, the resistance of the second static-pressure sealing portion to the positive-pressure air is lower than that of the first static-pressure sealing portion. Accordingly, the positive-pressure air can be caused to be discharged to the outside of the vacuum suction sticking unit through the fine gap between the second static-pressure sealing portion and the sample. Thus, the amount of the air flowing into the first static-pressure sealing portion can be reduced.

[Brief Description of the Drawings]

[Fig. 1] Fig. 1(a), (b) are a top view of a first embodiment of a vacuum suction sticking unit constituting the vacuum suction device of the present invention, and is an expanded cross-sectional view of the essential part thereof.

[Fig. 2] Fig. 2(a), (b) are a top view of a vacuum suction sticking unit according to a second embodiment of the present invention, and is an expanded cross-sectional view of the essential part thereof.

[Fig. 3] Fig. 3 is an expanded cross-sectional view of the essential part of a vacuum-suction sticking unit according

to a third embodiment of the present invention.

[Fig. 4] Fig. 4 is an expanded cross-sectional view of the essential part of a vacuum-suction sticking unit according to a fourth embodiment of the present invention.

[Fig. 5] Fig. 5(a) and (b) are a top view of a conventional vacuum-suction sticking unit, and is an expanded cross-sectional view of the essential part thereof.

[Reference Numerals]

1; vacuum-suction sticking unit

2; projection

3; vacuum-suction sticking portion

4; land

5; evacuating hole

6; sample

11, 12; projection

13; first static-pressure sealing portion

14; second static-pressure sealing portion

15; annular groove

17; positive-pressure supplying hole

22; positive-pressure air

23, 24; fine gap

30; evacuating groove

31; static-pressure sealing portion

32; ring

33; sealing member

35; fine gap

37, 38; step portion

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(71)出願人　000004226
日本電信電話株式会社
東京都新宿区西新宿三丁目19番２号

(72)発明者　露嵜　晴夫
東京都千代田区内幸町１丁目１番６号　日本電信電話株式会社内

(72)発明者　宇根　篤暢
東京都武蔵野市御殿山一丁目１番３号　エヌ・ティ・ティ・アドバンステクノロジ株式会社内

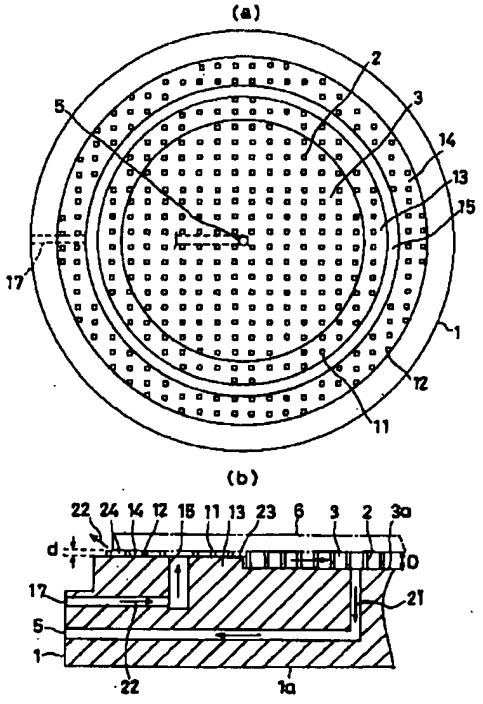
(74)代理人　弁理士　山川　政樹

(54)【発明の名称】　真空吸着装置

(57)【要約】

【目的】　ダスト等の影響を受けず、試料を高い平面に矯正する。

【構成】　突子２，１１，１２の上面は同一平面を形成し、試料６を支承する。第１、第２の静圧シール部１３，１４の上面高さは、突子２の上面高さより僅かに低く、試料６との間に微小隙間２３，２４を形成する。微小隙間２３，２４は大きな抵抗となり、真空吸引時に真空吸着部３に流れ込む空気の量を少なくする。陽圧空気２２は環状溝１５を陽圧状態にし、外部から空気が微小隙間２４に侵入しないようにする。微小隙間２３は、陽圧空気に対して大きな抵抗となり、真空吸着部３に流れ込む陽圧空気を少なくする。



1

【特許請求の範囲】

【請求項１】　上面が同一平面上にある多数の突子のみによって試料を支承し、内部に真空ポンプに接続される真空排気孔を設けた真空吸着器を備えた真空吸着装置であって、前記真空吸着器の上面中央部に前記真空排気孔に連通する真空吸着部を形成するとともに、この真空吸着部を取り囲むように形成され陽圧供給孔に連通する環状の陽圧部を設けたことを特徴とする真空吸着装置。

【請求項２】　上面が同一平面上にある多数の突子のみによって試料を支承し、内部に真空ポンプに接続される真空排気孔を設けた真空吸着器を備えた真空吸着装置であって、前記真空吸着器の上面に前記真空排気孔が連通する凹部によって形成された真空吸着部と、この真空吸着部を取り囲む環状の突部によって形成された第１の静圧シール部と、この第１の静圧シール部を取り囲む環状溝と、この環状溝を取り囲む環状の突部によって形成された第２の静圧シール部とを設け、前記真空吸着器の内部に前記環状溝に連通する陽圧供給孔を設け、前記第１、第２の静圧シール部の突子を真空吸着部の突子よりきわめて短く設定することにより第１、第２の静圧シール部の上面と試料との間に微小隙間が形成されるようにしたことを特徴とする真空吸着装置。

【請求項３】　上面が同一平面上にある多数の突子のみによって試料を支承し、内部に真空ポンプに接続される真空排気孔を設けた真空吸着器を備えた真空吸着装置であって、前記真空吸着器の上面に真空吸着部と、この真空吸着部を取り囲み前記真空排気孔が連通する真空排気溝と、前記真空吸着部と同一平面を形成し前記環状溝を取り囲む環状の第１の静圧シール部と、この第１の静圧シール部を取り囲む環状溝と、前記真空吸着部および第１の静圧シール部と同一平面を形成し前記環状溝を取り囲む環状の第２の静圧シール部とを設け、前記真空吸着器の内部に前記環状溝に連通する陽圧供給孔を設けたことを特徴とする真空吸着装置。

【請求項４】　請求項１，２または３に記載の真空吸着装置において、

突子をピン状に形成したことを特徴とする真空吸着装置。

【請求項５】　請求項２に記載の真空吸着装置において、

第２の静圧シール部を第１の静圧シール部より低くしたことを特徴とする真空吸着装置。

【請求項６】　請求項２に記載の真空吸着装置において、

環状溝にリングを着脱自在に設け、このリングの少なくとも上面に真空吸引時および陽圧空気の供給時に試料の裏面に密着する環状のシール部材を固着したことを特徴とする真空吸着装置。

【発明の詳細な説明】

【０００１】

2

【産業上の利用分野】本発明は、ＬＳＩ製造装置におけるパターン転写装置、描画装置、各種プロセス製造装置、検査測長装置、および研削、研磨、切断などの加工装置に用いられる真空吸着装置に関し、特にその真空吸着器に関するものである。

【０００２】

【従来の技術】従来、ＬＳＩ製造において用いられるこの種の真空吸着装置は、図５（ａ）、（ｂ）に示すような真空吸着器を備えている。これを概略説明すると、１は真空吸着器で、その上面中央部にはウエハ等の試料６を吸着する多数の微小な突子２を有する真空吸着部３が設けられ、さらにその外側には環状の突部からなるランド部４が設けられている。ランド部４は突子２と同じ高さを有し、上面が仕上げ加工されることにより高精度な平面を形成している。同様に、突子２の上面も仕上げ加工されることにより高精度な平面を形成している。また、真空吸着器１の内部には一端が真空吸着部３の底面３ａに開口し、他端が真空吸着器１の下面１ａに開口する４つの真空排気孔５が形成されており、その他端開口部は図示しない真空ポンプに接続されている。

【０００３】このような構造において、真空吸着器１の上面に試料６を載置した後、真空ポンプを作動させて試料６の下部の空気を真空排気孔５から排気すると、真空吸着部３が負圧となるため、試料６は突子２およびランド部４上に吸着される。ランド部４の上面は突子２の上面と同一平面を形成しており、試料６の外周縁部下面が密接することで、ランド部４の内側、すなわち真空吸着部３を真空封止する。試料６は真空吸着されることで突子２およびランド部４の高精度に仕上げ加工された上面に倣い、反りや曲がりが矯正される。

【０００４】

【発明が解決しようとする課題】上記した従来の真空吸着装置の真空吸着器にあっては、真空排気によって試料６を真空吸着部３の突子２とランド部４の上面に吸着することにより、試料６の反りや変形を矯正し平面にすることができる。また、突子２により真空吸着器１と試料６との接触面積をきわめて小さくすることができるので、ダスト等による平面度の低下は殆ど生じない。この場合、単に突子２のみで試料６を支承する構造にすると、真空吸着部３が外部と連通して試料６を吸着するのに十分な真空度が得られず、また外部の空気や加工液を吸い込んでしまい、試料６や真空吸着器を汚染する。そこで、従来は真空吸着部３を真空封止するためにランド部４を設けている。真空封止を十分に行うためにはランド部４の幅を広くすることが必要となるが、幅が広くなればなるほど、ランド部４上にダスト等が付着する確率が高くなり、試料の外周部を高精度な平面に矯正できないという問題があった。

【０００５】本発明は上記した従来の問題点に鑑みてなされたもので、その目的とするところは、突子のみによ

る支承にも拘らず試料を確実に吸着することができ、試料外周部においてもダスト等の影響を受けず、試料を高い平面に矯正することができる真空吸着装置を提供することにある。

【０００６】

【課題を解決するための手段】上記目的を達成するため、本発明は、上面が同一平面上にある多数の突子のみによって試料を支承し、内部に真空ポンプに接続される真空排気孔を設けた真空吸着器を備えた真空吸着装置であって、前記真空吸着器の上面中央部に前記真空排気孔に連通する真空吸着部を形成するとともに、この真空吸着部を取り囲むように形成され陽圧供給孔に連通する環状の陽圧部を設けたことを特徴とする。また、本発明は、上面が同一平面上にある多数の突子のみによって試料を支承し、内部に真空ポンプに接続される真空排気孔を設けた真空吸着器を備えた真空吸着装置であって、前記真空吸着器の上面に前記真空排気孔が連通する凹部によって形成された真空吸着部と、この真空吸着部を取り囲む環状の突部によって形成された第１の静圧シール部と、この第１の静圧シール部を取り囲む環状溝と、この環状溝を取り囲む環状の突部によって形成された第２の静圧シール部とを設け、前記真空吸着器の内部に前記環状溝に連通する陽圧供給孔を設け、前記第１、第２の静圧シール部の突子を真空吸着部の突子よりきわめて短く設定することにより第１、第２の静圧シール部の上面と試料との間に微小隙間が形成されるようにしたことを特徴とする。また、本発明は、上面が同一平面上にある多数の突子のみによって試料を支承し、内部に真空ポンプに接続される真空排気孔を設けた真空吸着器を備えた真空吸着装置であって、前記真空吸着器の上面に真空吸着部と、この真空吸着部を取り囲み前記真空排気孔が連通する真空排気溝と、前記真空吸着部と同一平面を形成し前記環状溝を取り囲む環状の第１の静圧シール部と、この第１の静圧シール部を取り囲む環状溝と、前記真空吸着部および第１の静圧シール部と同一平面を形成し前記環状溝を取り囲む環状の第２の静圧シール部とを設け、前記真空吸着器の内部に前記環状溝に連通する陽圧供給孔を設けたことを特徴とする。また、本発明は、突子をピン状に形成したことを特徴とする。また、本発明は、第２の静圧シール部を第１の静圧シール部より低くしたことを特徴とする。さらに、本発明は、環状溝にリングを着脱自在に設け、このリングの少なくとも上面に真空吸引時および陽圧空気の供給時に試料の裏面に密着する環状のシール部材を固着したことを特徴とする。

【０００７】

【作用】本発明においては、試料を接触面がきわめて小さい突子のみで支承するから、ダスト等による平面度に及ぼす影響がほとんどない。真空吸着部を取り囲む環状の陽圧部は、陽圧空気の供給によって陽圧状態となるから、外部からダスト、加工液等が侵入するのを阻止する。また、本発明は２つの静圧シール部を真空吸着部の外側に設けて試料との間に微小隙間を形成するとともに、環状溝に陽圧空気を供給している。こうすることにより真空排気時に静圧シール部と試料との間の微小隙間が大きな抵抗となるため、真空吸着部に吸い込まれる空気の量はきわめて僅かで、真空吸着部を真空排気することができ、試料を吸着する。一方、陽圧空気の供給によって、静圧シール部が陽圧状態となるから外部からダストや加工液が侵入するのを阻止される。この陽圧空気の一部は真空吸着部に流れ込むが、静圧シール部と試料との間に設けた微小隙間が大きな抵抗となるため、真空吸着部内に流れ込む陽圧空気の量は僅かで、試料の真空吸着には影響を及ぼさない。また、環状溝内にシール部材を設け、このシール部材を真空吸着時および陽圧空気の供給時に試料に密着させると、真空吸着部を真空封止するので、外部の空気や加工液が侵入することがない。

【０００８】

【実施例】以下、本発明を図面に示す実施例に基づいて詳細に説明する。図１（ａ）、（ｂ）は本発明に係る真空吸着装置を構成する真空吸着器の第１の実施例を示す平面図および要部の拡大断面図である。なお、図中従来技術の欄で説明したものと同一構成部材等については同一符号を付し、その詳細な説明を省略する。同図において、本実施例における厚肉の円板状に形成した真空吸着器１には、上面中央部に小さな四角で示す多数の微小な突子２を有する円形の凹部によって形成された真空吸着部３が設けられ、その外側に同じく多数の微小な突子１１，１２をそれぞれ有する環状の突部からなる第１，第２の静圧シール部１３，１４が同心円状に突設されている。また、本実施例はこれら両静圧シール部１３，１４間に陽圧部を形成する環状溝１５を設け、真空吸着器１の内部に真空排気孔５と陽圧供給孔１７を形成したものである。真空吸着部３の深さＤ、言い換えれば突子２の高さは１００μｍから１ｍｍ程度である。第１の静圧シール部１３と第２の静圧シール部１４の高さ（真空吸着部３の底面３ａからの高さ）は等しく、かつ真空吸着部３の深さＤより僅かに（１００分の１から１０分の１程度）小さい。真空吸着部３および第１、第２の静圧シール部１３，１４の各突子２，１１，１２は同一の太さのピン状に形成され、その上面が高精度な平面に仕上げ加工されるとともに同一平面を形成している。第１、第２の静圧シール部１３，１４の突子１１，１２の高さｄは数μｍ～５０μｍ以下で、真空吸着部３の突子２の高さＤよりかなり短い。このため、第１、第２の静圧シール部１３，１４と試料６との間には微小隙間２３，２４がそれぞれ形成される。そして、これらの突子２，１１，１２は、円形、正方形等の適宜な断面形状を有し、試料６との接触面積を減らすためにできるだけ細く形成されるとともに、真空吸着時に試料６の厚さに応じて試料６に撓みを生じさせない程度の間隔をおいて設けられる。

なお、突子2，11，12の材料としてはセラミックス、鉄、チタン等が用いられ、真空吸着器1の材料としてはセラミックス、焼き入れした金属等が用いられる。

【0009】前記真空排気孔5の一端は前記真空吸着部3の底面3aに開口し、他端が真空吸着器1の側面に開口して図示しない真空ポンプに接続されている。前記陽圧供給孔17の一端は前記環状溝15の外周壁に開口し、他端が真空吸着器1の側面に開口して図示しないコンプレッサ等の陽圧供給手段に接続されている。

【0010】このような構造において、図示しない真空ポンプによって真空排気孔5内の空気を排気すると、空気は矢印21で示す方向に流れ、真空吸着部3内が負圧となる。したがって、試料6は大気圧によって突子2，11，12の上面に押しつけられて反りや曲がりが矯正される。この時、第1の静圧シール部13は、その上面が突子11の上面より僅かに低く設定されることにより試料6の裏面との間に微小隙間23を形成しているので、真空吸着部3に流れ込む空気の量はきわめて少なく、真空吸着部3を真空排気することができ、試料6を吸着することができる。次に、コンプレッサ等の陽圧供給手段の作動によって陽圧空気22を陽圧供給孔17を通じて環状溝15に供給し、環状溝15および第1、第2の静圧シール部13，14を陽圧状態にする。そして、この陽圧空気22は、試料6と第1、第2の静圧シール部13，14間の微小隙間24を通って真空吸着部3と真空吸着器1の外部に排出される。この時、第1の静圧シール部13は陽圧空気に対して大きな抵抗となるため、真空吸着部3に流れ込む陽圧空気22の量はきわめて僅かである。したがって、試料6の真空吸着には影響を及ぼすことがない。また、第2の静圧シール部14から外部に排出される陽圧空気は、試料6の裏面外周部に付着したダストを除去し、また加工時に真空吸着器1内に加工液やダストが侵入するのを阻止する。したがって、試料6の裏面と真空吸着器1の真空吸着面、すなわち突子2，11，12の上面の汚染を防止することができる。

【0011】一例として、500μmより厚い試料6を吸着する場合、突子2，11，12の間隔を1mm、突子2，11，12の大きさを1辺が0．2mmの角形とすると、試料6の撓みは殆ど観察されず、かつ試料6の裏面と突子2，11，12の上面との接触率は4％ときわめて小さい。したがって、試料6の被吸着面全面にわたってダストの影響は小さく、高い平面度が得られる。また、突子2，11，12をピン状に形成しているので、ダスト等の付着も少ない。

【0012】図2（a）、（b）は本発明の第2の実施例を示す真空吸着器の平面図および要部の拡大断面図である。この実施例における真空吸着器1は、真空吸着器1の上面中央部を円形の真空吸着部3とし、この真空吸着部3の外側に環状の真空排気溝30、環状の第1の静圧シール部13、環状溝15および第2の静圧シール部14を同心円状に設けたものである。また、真空吸着部3および第1、第2の静圧シール部13，14に断面形状が円形からなる多数の微小な突子2，11，12をそれぞれ突設し、かつ真空吸着器1の内部に真空排気孔5と陽圧供給孔17を形成したものである。真空吸着部3と第1、第2の静圧シール部13，14の突子2，11，12が突設されている面は、同一平面を形成している。また、突子2，11，12は、高さdが例えば数μmから50μmで全て等しく、上面が同一平面を形成している。このため、試料6と真空吸着部3、第1、第2の静圧シール部13，14との間にはそれぞれきわめて微小な隙間が形成される。真空排気孔5の一端は前記真空排気溝30に接続され、他端が真空吸着器1の側面に開口し、図示しないポンプに接続されている。真空排気溝30は、真空の立ち上がりを向上させるために真空排気孔5を多数形成する代わりに設けられている。

【0013】このような構造においても試料6の裏面と突子2，11，12との接触率はきわめて小さく、したがって、試料6の被吸着面全面にわたってダストによる影響は小さく、高い平面度が得られる。また、第1の静圧シール部13を真空吸着部3の外側に設け、試料6との間に微小隙間を形成しているので、真空吸着時にダスト等が真空吸着部3に流れ込むことがなく、また陽圧空気の供給時には真空吸着部3に流れ込む陽圧空気22の量を少なくすることができる。したがって、試料6を確実に真空吸着することができる。また、環状溝15の外側に第2の静圧シール部14を設け、試料6との間に微小隙間を形成しているので、第2の静圧シール部14を陽圧状態にすることができ、加工液やダストが侵入するのを確実に防止することができる。

【0014】図3は本発明の第3の実施例を示す真空吸着器の要部の拡大断面図である。この実施例における真空吸着器1は、図1に示した第1の実施例における第2の静圧シール部14の高さを第1の静圧シール部13より若干低く設定し、試料6と第2の静圧シール部14間の微小隙間24を試料6と第1の静圧シール部13間の微小隙間23より大きく設定したものである。その他の構成は同様である。

【0015】このような構造において、真空吸引孔5内の空気を排気して試料6を真空吸引した後、陽圧供給孔17より環状溝15に陽圧空気22を供給する。この時、真空吸着部3と環状溝15間の差圧は、陽圧空気22を真空吸着器1の外部に吹き出す第2の静圧シール部14の外側の大気圧と環状溝15間の差圧より大きいため、陽圧空気22は真空吸着部3へ多く流れようとするが、第2の静圧シール部14と試料6間の微小隙間24が試料6と第1の静圧シール部13間の微小隙間23より大きく設定されているので、第2の静圧シール部14の抵抗が小さくなり、大部分の陽圧空気22は微小隙間

２４を通って真空吸着器１の外部へ排出される。したがって、このような構造においても真空吸着部３を確実に真空封止することができ、外部から加工液が微小隙間２４に侵入するのを阻止することができる。

【００１６】図４は本発明の第４の実施例を示す真空吸着器の要部の拡大断面図である。この実施例における真空吸着器１は、図１に示した第１の実施例の環状溝１５に２枚のシール部材３３を備えたリング３２を嵌挿し、これらシール部材３３によって真空吸着部３を真空封止するようにしたものである。

【００１７】前記リング３２は、環状溝１５の内周壁に沿って着脱自在に嵌挿されている。リング３２の上下面の径方向外側半分は、全周にわたって内側半分よりも一段低く形成されることにより環状の段差部３７，３８をそれぞれ形成している。各シール部材３３はポリイミドなどの高分子膜によって形成されたきわめて薄い（１０μｍ～３０μｍ程度）リング状のシートからなり、その径方向内側半分が全周にわたってリング３２の上下面にそれぞれ固着されている。そして、シール部材３３の外側半分はリング３２に固着されておらず、前記段差部３７，３８の上方および下方にそれぞれ延在している。上側のシール部材３３は、真空排気時および陽圧空気の供給時に試料６の裏面に密着することにより、真空吸着部３を真空封止する。下側のシール部材３３は、陽圧空気２２の供給時に環状溝１５の内底面に押し付けられることにより、環状溝１５の内周壁とリング３２との隙間をシールする。段差部３７，３８はシール部材３３との間に隙間を設け、これらシール部材に対して陽圧空気２２が作用し易くする。また、上側段差部３７は不使用時の上側シート部材３３の垂れ下がりを防止し、下側段差部３８は真空排気時の下側シート部材３３の上方への変形を少なくする。

【００１８】このような構造において、ウエハなどの試料６を真空吸着器１上に載置し、真空ポンプにより真空排気孔５を真空排気すると、試料６は突子２，１１，１２上に吸着される。したがって、試料６は突子２，１１，１２の上面に倣い、反りや曲がりが矯正される。この時、上側のシール部材３３は図に示すように上方に吸い上げられて試料６の裏面に密着し真空吸着部３を真空封止する。

【００１９】次に、陽圧供給孔１７から陽圧空気２２を環状溝１５に供給すると、第１、第２の静圧シール部１３，１４が陽圧空気２２に対して大きな抵抗となるため、環状溝１５が陽圧状態となり、上側のシール部材３３を試料６の裏面に押し付け、下側のシール部材３３を環状溝１５の内底面に押し付ける。したがって、真空吸着部３は完全に真空封止される。この状態で加工液を流し、試料６の加工を行えば、第２の静圧シール部１４さらには環状溝１５、第１の静圧シール部１３および真空吸着部３へ加工液が侵入するのを阻止することができる。したがって、上記した第１、第２の実施例と同様に試料６の裏面と真空吸着器１の真空吸着面の汚染を防止することができる。

【００２０】また、このような構造においては、大きく上方に反った試料６を吸着する際に効果を発揮する。すなわち、上方に大きく反った試料６の場合、その裏面外周部が突子１２と接触せず、第２の静圧シール部１４との間に大きな隙間が形成されることになるため、真空排気孔５内の空気を排気しても真空吸着部３の真空度は上がらないが、環状溝１５にリング３２とシール部材３３を設けておくと、上側のシール部材３３の外周側端部が上方に持ち上げられて試料６の裏面に密着し、真空吸着部３を塞ぐ。したがって、真空吸着部３の真空度が上がり、試料６を吸着する。また、上側のシール部材３３は環状溝１５に陽圧空気２２が供給されると、試料６の裏面に押し付けられるため真空吸着部３を的確に塞ぐ。一方、下側のシール部材３３は、陽圧空気２２が環状溝１５に供給されると、環状溝１５の内底面に押し付けられるので、環状溝１５の内周壁とリング３２との隙間をシールする。

【００２１】また、本実施例においては、リング３２を環状溝１５内にその内周壁に沿って着脱自在に設けているため、大きく反った試料６を真空吸着する場合にのみ適用し、その他の場合には取り外すことができる。したがって、シール部材３３の劣化を防ぎ、長期にわたって使用することができる。

【００２２】なお、上記した第１～第４の実施例はいずれも突子２，１１，１２を微小なピン状に形成した例を示したが、これに限らず環状や渦巻状の細長い突子であってもよい。また、上記した第１～第４の実施例はいずれも真空吸着部３を円形に形成したが、矩形や楕円形に形成してもよい。また、図４に示した第４の実施例においてはリング３２の上下面にシール部材３３をそれぞれ固着した例を示したが、上面にのみ固着した場合でも微小隙間２３を真空封止することができる。

【００２３】

【発明の効果】以上説明したように本発明に係る真空吸着装置は、上面が同一平面上にある多数の突子のみによって試料を支承し、内部に真空ポンプに接続される真空排気孔を設けた真空吸着器を備えた真空吸着装置であって、前記真空吸着器の上面中央部に前記真空排気孔に連通する真空吸着部を形成するとともに、この真空吸着部を取り囲むように形成され陽圧供給孔に連通する環状の陽圧部を設けたので、従来のように試料の裏面外周部を支承するランド部を設ける必要がなく突子のみによって支承するから、試料と真空吸着器の接触面積を小さくすることができる。したがって、ダストの影響が少なく、試料の反りや曲がりを矯正して高い平面を得ることができる。また、加工時に陽圧部は陽圧状態となることにより外部からダストや加工液が侵入することはない。

【００２４】また、本発明は、真空吸着部を凹部によって形成したので、真空排気部内の真空圧分布が均一となり、試料を良好に吸着することができる。

【００２５】また、本発明は、真空吸着部と第１，第２の静圧シール部を同一平面に形成したので、真空吸着器の加工形成が容易である。

【００２６】また、本発明は、真空吸着器に真空吸着部と第１の静圧シール部との間に環状の真空排気溝を形成し、これに真空排気孔を接続したので、真空排気時の真空の立ち上がりを向上させることができ、短時間で試料を真空吸着することができる。

【００２７】また、本発明は、第１，第２の静圧シール部間に環状溝を設け、この環状溝に環状のシール部材を備えたリングを配置し、真空吸引時および陽圧空気の供給時にシール部材を試料の裏面に密着させるようにしたので、真空吸着時および陽圧空気の供給時に真空吸着部を確実に真空封止することができる。また、このようなシール部材を用いると、上方に大きく反った試料を吸着する際に真空吸着部の真空度を上げることができ、試料を確実に真空吸着することができる。

【００２８】さらに、本発明は、第２の静圧シール部を第１の静圧シール部より低く設定し、陽圧空気に対する第２の静圧シール部の抵抗を第１の静圧シール部の抵抗より小さくしたので、陽圧空気を試料と第２の静圧シー＊



＊ル部間の微小隙間を通って真空吸着器の外部に排出することができ、第１の静圧シール部に流れ込む空気の量を少なくすることができる。

【図面の簡単な説明】

【図１】　（ａ）、（ｂ）は本発明に係る真空吸着装置を構成する真空吸着器の第１の実施例を示す平面図および要部の拡大断面図である。

【図２】　（ａ）、（ｂ）は本発明の第２の実施例を示す真空吸着器の平面図および要部の拡大断面図である。

【図３】　本発明の第３の実施例を示す真空吸着器の要部の拡大断面図である。

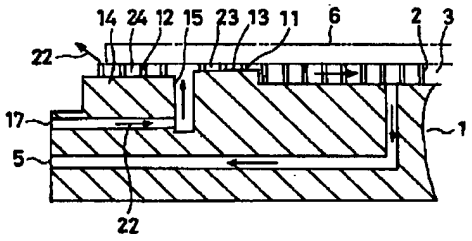
【図４】　本発明の第４の実施例を示す真空吸着器の要部の拡大断面図である。

【図５】　（ａ）、（ｂ）は従来の真空吸着器の平面図および要部の拡大断面図である。

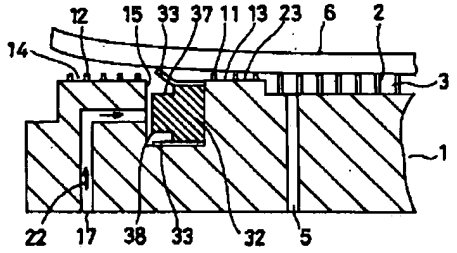
【符号の説明】

１…真空吸着器、２…突子、３…真空吸着部、４…ランド部、５…真空排気孔、６…試料、１１，１２…突子、１３…第１の静圧シール部、１４…第２の静圧シール部、１５…環状溝、１７…陽圧供給孔、２２…陽圧空気、２３，２４…微小隙間、３０…真空排気溝、３１…静圧シール部、３２…リング、３３…シール部材、３５…微小隙間、３７，３８…段差部。

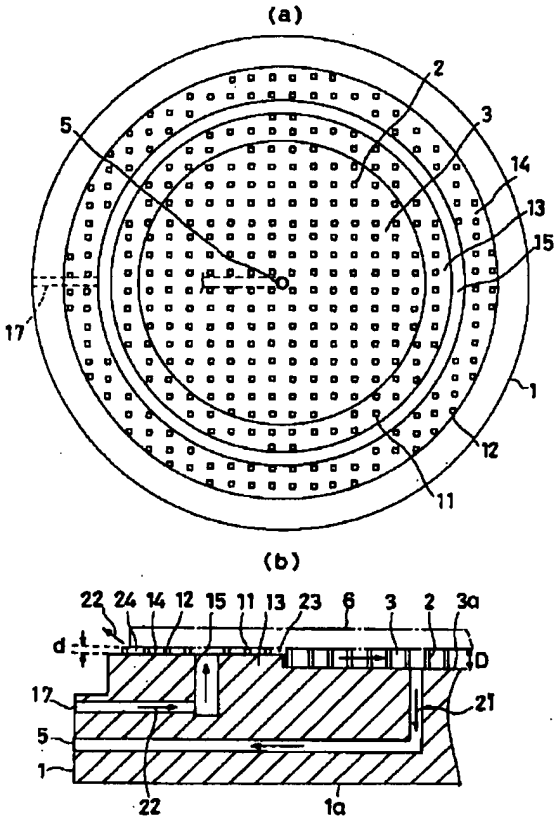
【図３】




【図４】



【図1】


(a)
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12
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(b)
22 24 14 12 15 11 13 23 6 3 2 3a
d
D
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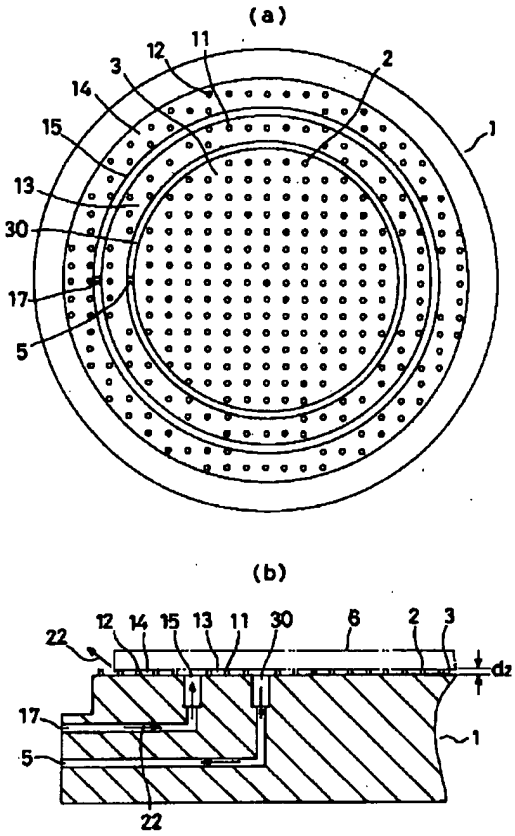
21
5
1
22
1a

【図2】


(a)
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17
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(b)
12 14 15 13 11 30 6 2 3
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d2
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22

【図5】